

Kinematic Equations

Name

Date

- a. An airplane accelerates down a runway at 3.20 m/s^2 for 32.8 s until it finally lifts off the ground. Determine the distance traveled before takeoff.
- b. A car starts from rest and accelerates uniformly over a time of 5.21 seconds for a distance of 110 m . Determine the acceleration of the car.
- c. Upton Chuck is riding the Giant Drop at Great America. If Upton free falls for 2.6 seconds , what will be his final velocity and how far will he fall?
- d. A race car accelerates uniformly from 18.5 m/s to 46.1 m/s in 2.47 seconds . Determine the acceleration of the car and the distance traveled.
- e. Rocket-powered sleds are used to test the human response to acceleration. If a rocket-powered sled is accelerated to a speed of 444 m/s in 1.8 seconds , then what is the acceleration and what is the distance that the sled travels?
- f. A bike accelerates uniformly from rest to a speed of 7.10 m/s over a distance of 35.4 m . Determine the acceleration of the bike.
- g. An engineer is designing the runway for an airport. Of the planes that will use the airport, the lowest acceleration rate is likely to be 3 m/s^2 . The takeoff speed for this plane will be 65 m/s . Assuming this minimum acceleration, what is the minimum allowed length for the runway?

h. A car traveling at 22.4 m/s skids to a stop in 2.55 s. Determine the skidding distance of the car (assume uniform acceleration).

i. A kangaroo is capable of jumping to a height of 2.62 m. Determine the takeoff speed of the kangaroo.

j. If Michael Jordan has a vertical leap of 1.29 m, then what is his takeoff speed and his hang time (total time to move upwards to the peak and then return to the ground)?

k. A bullet leaves a rifle with a muzzle velocity of 521 m/s. While accelerating through the barrel of the rifle, the bullet moves a distance of 0.840 m. Determine the acceleration of the bullet (assume a uniform acceleration).

l. A baseball is popped straight up into the air and has a hang-time of 6.25 s. Determine the height to which the ball rises before it reaches its peak. (Hint: the time to rise to the peak is one-half the total hang-time.)

m. It was once recorded that a Jaguar left skid marks that were 290 m in length. Assuming that the Jaguar skidded to a stop with a constant acceleration of -3.90 m/s^2 , determine the speed of the Jaguar before it began to skid.

n. With what speed in miles/hr ($1 \text{ m/s} = 2.23 \text{ mi/hr}$) must an object be thrown to reach a height of 91.5 m (equivalent to one football field)? Assume negligible air resistance.